Recovery Plan for Kurri Sand Swamp Woodland

Foreword

This document constitutes the formal New South Wales state recovery plan for the endangered ecological community Kurri Sand Swamp Woodland (KSSW) and, as such, considers the conservation requirements of the community across its known range. It identifies the actions to be taken to ensure the long-term viability of the KSSW in nature and the parties who will undertake these actions.

The KSSW is listed as an endangered ecological community on Schedule 1 Part 3 of the NSW Threatened Species Conservation Act 1995. This woodland is restricted to soils that occur over sand deposits in the Kurri Kurri and Cessnock areas in the Lower Hunter Valley. The main threats to the community are continued habitat loss and fragmentation; and habitat degradation due to physical disturbance, weed invasion, changes to drainage conditions and nutrient levels, frequent fire and inappropriate hazard reduction activities.

The overall objective of this recovery plan is to maintain and improve the current extent, condition and ecological function of KSSW across the communities entire pre-European settlement distribution. Specific recovery objectives include:

• gain greater insight into the distribution, floristics, and variance within KSSW and to investigate the relative significance of KSSW remnants;
• provide public authorities with information that assists in conserving and managing KSSW;
• raise awareness of KSSW and facilitate community involvement in the recovery program;
• identify and minimise the threats operating at sites where KSSW occurs and ensure appropriate ecological restoration where necessary and feasible;
• initiate potential conservation of KSSW on private property;
• promote research and monitoring projects that will assist future management decisions; and
• broaden legislative protection afforded KSSW.

It is intended that the recovery plan will be implemented over a five year period. This recovery plan is to be implemented by the Department of Environment and Climate Change, Rural Fire Service, Cessnock City Council, Hunter-Central Rivers Catchment Management Authority, Department of Lands, and Forests NSW. Recovery Plan implementation will be overseen by the Hunter Valley Threatened Flora Recovery Team and a number of community groups are also involved in its implementation.

The total cost to implement this plan is estimated to be at least $224,400 over five years. Over half of the required funds ($130,000) have already been provided by external sources, including the NSW Roads and Traffic Authority, Hunter-Central Rivers Catchment Management Authority (Natural Heritage Trust funding) and its sub-committee the Wallis, Fishery and Four Mile Creek Catchment Management Forum, the NSW Department of Premier and Cabinet, and Cessnock City Council. The DECC will make an in-kind contribution of $47,400.

LISA CORBYN
Director General

VERITY FIRTH MP
Minister for Climate Change
and the Environment

Implementation of this plan commenced in 2006 with publication of the draft plan. Consequently many of the actions are now completed or underway and an additional $33,200 has been secured for recovery plan implementation from the Hunter-Central Rivers Catchment Management Authority (Environmental Education Grant), Cessnock City Council and Hydro Aluminium. An additional $240,000 has also been secured to contribute towards research priorities identified in this plan (NHT Strategic Reserve Grant).
Acknowledgments

This recovery plan was prepared with financial support from the NSW Roads and Traffic Authority (RTA) and under the guidance of the Kurri Sand Swamp Woodland Recovery Team. The Department of Environment and Climate Change (DECC) wishes to acknowledge the RTA and the following recovery team members and their organisations for their contributions to the development of this recovery plan: Doug Beckers, Deon van Rensburg (DECC), Sarah Roberts (Cessnock City Council), Stephen Bell (Eastcoast Flora Survey), Mark Evans (EnergyAustralia), Adam Fawcett (Forests NSW), Lucas Grenadier (DECC), Anna Ferguson (Hunter-Central Rivers Catchment Management Authority), Paul Wenta (Hydro Aluminium), Anthony Signor, Rob Micheli (Department of Lands), James Ryan (local community representative), Angela Riepsamen (RTA), and David Hislop (Rural Fire Service).

Various organisations have already provided financial support towards the implementation of this recovery program and their support is greatly acknowledged. The Hunter-Central Rivers Catchment Management Authority and its sub-committee the Wallis, Fishery and Four Mile Creek Catchment Management Forum, the NSW Department of Premier and Cabinet, and Cessnock City Council have contributed funds towards the implementation of Specific Objective 1: To gain greater insight into the distribution, floristics, and variance within KSSW and to investigate the relative significance of KSSW remnants.2

The DECC would also like to acknowledge the members of the local Kurri Kurri and Cessnock communities, who have been, and continue to be, actively involved in the conservation of Kurri Sand Swamp Woodland. In particular, the following local community groups: Friends of Werakata National Park, Friends of Tumblebee, and Kurri Kurri Tidy Towns.

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2 Additional funds have since been secured from the Hunter-Central Rivers Catchment Management Authority (Environmental Education Grant) and Cessnock City Council to implement Action 3.5. Hydro Aluminium has also contributed funds towards implementation of Specific Objective 1. The support of these organisations is greatly acknowledged.
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1 Introduction

Kurri Sand Swamp Woodland (KSSW) is a woodland community that occurs only in New South Wales (NSW), and is restricted to soils that occur over sand deposits within the Kurri Kurri and Cessnock areas in the Lower Hunter Valley. Available information suggests as much as 50 per cent of this woodland may have been cleared due to urban and industrial development and now only approximately 2500 hectares remains. The remaining areas are threatened by continued habitat loss and habitat degradation due to physical disturbance (e.g. rubbish dumping, trail bike riding), weed invasion, changes to drainage conditions and nutrient levels, frequent fire and inappropriate hazard reduction activities.

This document constitutes the formal recovery plan for KSSW and, as such, considers the requirements of the community across its known range. It identifies the actions to be taken to ensure the long-term viability of the community in nature and the parties who will undertake these actions. The attainment of the objectives of this recovery plan is subject to budgetary and other constraints affecting the parties involved.

This plan has been prepared by the Department of Environment and Climate Change (NSW) (DECC) in consultation with the KSSW Recovery Team.

2 Legislative Context

2.1 Legal status

The KSSW is listed as an endangered ecological community on Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act). The community is currently not listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). One of the actions within this plan is to nominate the community as a threatened ecological community under the EPBC Act.

3 Based on regional scale mapping (NPWS (2000) and Predavec et al. (2001)) and likely to be revised following further investigations into the floristics and distribution of KSSW to be undertaken as part of recovery plan implementation.

2.2 Responsibilities under the Threatened Species Conservation Act 1995

Recovery plan preparation, exhibition and implementation

The TSC Act provides a legislative framework to protect and encourage the recovery of threatened species, populations or ecological communities in NSW. Under this legislation the Director General of the DECC may prepare recovery plans for species, populations and ecological communities listed as critically endangered, endangered or vulnerable on the TSC Act schedules. The TSC Act includes specific requirements for both the matters to be addressed by recovery plans and the process for preparing recovery plans. This recovery plan satisfies these provisions.

This recovery plan was on public exhibition from 20th October 2006 until 1st December 2006.

The TSC Act requires that a public authority must take appropriate measures to implement the actions in a recovery plan for which they have agreed to be responsible. The actions identified in this plan for the recovery of KSSW in NSW are the responsibility of the DECC, Rural Fire Service, Cessnock City Council, Hunter-Central Rivers Catchment Management Authority, Department of Lands, and Forests NSW. Other public authorities may have statutory responsibilities relevant to the conservation and protection of KSSW. The TSC Act requires that a government agency must not undertake actions inconsistent with a recovery plan.

The Threatened Species Conservation Amendment Act 2002 states that an approved Recovery Plan must include a summary of advice given by the NSW Scientific Committee with respect to the plan, details of any amendments made to the plan to take account of that advice and a statement of the reasons for any departure from that advice. This summary is provided in Appendix 1.

Consultation with indigenous people

Local Aboriginal Land Councils, Elders and other groups representing indigenous people in the areas where the KSSW occurs have been identified and a copy of the draft recovery plan was sent to them. It is also the intention of the DECC to consider the role and interests of these indigenous communities in the implementation of the actions identified in this plan.

4 For the remainder of this document the term ‘threatened species’ is used to refer to the whole statutory formulation of ‘threatened species, populations or ecological communities’.

3 Based on regional scale mapping (NPWS (2000) and Predavec et al. (2001)) and likely to be revised following further investigations into the floristics and distribution of KSSW to be undertaken as part of recovery plan implementation.

4 For the remainder of this document the term ‘threatened species’ is used to refer to the whole statutory formulation of ‘threatened species, populations or ecological communities’.
Critical habitat

The TSC Act makes provision for the identification and declaration of critical habitat for species and ecological communities listed as endangered or critically endangered and endangered populations. Once declared, it becomes an offence to damage critical habitat (unless the action is specifically exempted by the TSC Act) and a Species Impact Statement (SIS) is mandatory for all developments and activities proposed within critical habitat.

To date, critical habitat has not been declared for KSSW. The declaration of critical habitat is not considered to be a priority for KSSW at this stage, as other mechanisms provide for its protection.

Key threatening processes

As of September 2005 there are 27 key threatening processes listed on the TSC Act. Of these at least ten are likely to, or potentially, threaten Kurri Sand Swamp Woodland, including: 'Bushrock removal', 'Clearing of native vegetation', 'High frequency fire resulting in the disruption of life cycle processes in plants and animal and loss of vegetation structure and composition', 'Infection of native plants by Phytophthora cinnamomi', 'Invasion of native plant communities by exotic perennial grasses', and also potentially 'Alteration of habitat due to subsidence due to longwall mining', 'Anthropogenic climate change', 'Competition from feral honeybees Apis mellifera', 'Introduction of the Large Earth Bumblebee, Bombus terrestris', and 'Alteration of habitat due to subsidence due to longwall mining'. In addition to these key threatening processes, a range of other processes are recognised as threatening the survival of the community in NSW (see Section 4).

Licensing

Any activity not requiring development consent under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) or the NSW Native Vegetation Act 2003 (NV Act), which is likely to pick flora or harm fauna within KSSW, requires a licence from the DECC under the provisions of the TSC Act or the NSW National Parks and Wildlife Act 1974 (NPW Act) as a defence against prosecution. If the impact is likely to be significant, a SIS is required.

Other conservation measures

The TSC Act includes provision for other measures that may be taken to conserve KSSW and its habitat, including the making of a Stop Work Order or Joint Management Agreement.

2.3 Relationship to other legislation

The TSC Act interacts with other NSW legislation and planning instruments in a number of ways. Additional legislation relevant to the conservation and recovery of KSSW in NSW includes the following:

- Environmental Planning and Assessment Act 1979;
- National Parks and Wildlife Act 1974;
- Native Vegetation Act 2003;
- Rural Fires Act 1997;
- Rural Fires and Environmental Assessment Legislation Amendment Act 2002
- Local Government Act 1993;
- Forestry and National Park Estate Act 1998; and

3 Biological Information

3.1 Description

KSSW is the name given to an ecological community that occurs on soils developed over sand deposits in the Kurri Kurri and Cessnock areas of the Lower Hunter Valley, NSW. KSSW generally ranges from low open-woodland to low woodland and open scrub with a low open canopy that rarely exceeds 15m in height.

Recent vegetation surveys within the distribution of KSSW (Bell 2004a and 2004b; FloraSearch 2004) have revealed that the floristics of KSSW are more complex and varied than indicated in the original description of the community (NSW National Parks and Wildlife Service 2000) and in the final determination (NSW Scientific Committee 2001). There are a number of observable combinations of canopy and understorey species and it appears this variation in floristic composition reflects variation in soil type (specifically the relative proportions of sand and clay) and the related drainage patterns (Bell 2004b).

The canopy of KSSW is typically dominated by various combinations of the following taxa: Angophora bakeri, Corymbia gummifera, Eucalyptus sp. aff. agglomerata, Eucalyptus capitellata, Eucalyptus fibrosa, Eucalyptus parramattensis subsp. decadens, Eucalyptus punctata, Eucalyptus racemosa, and Eucalyptus resinifera. Scrub and heath variants are also present, where a stunted and widely spaced canopy of trees occurs.

Understorey vegetation is dominated by a range of shrubs typical of sand environments, but with
clay species such as *Melaleuca nodosa* also prominent in some parts.

Given that KSSW is a variable vegetation community the dominant species varies among sites (Bell 2004a). In some areas, KSSW is dominated by *Angophora bakeri*, *Eucalyptus parramattensis* subsp. *decadens* and *Corymbia gunnifera*, over an understorey of species such as *Isopogon anemonifolius*, *Banksia oblongifolia*, *Hakea laevis*, *Dillwynia retorta*, *Leptospermum trinervium* and *Acacia ulicifolia*. In other areas where soils have a higher clay content, a canopy dominated by stunted *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus fibrosa* may occur, with understorey vegetation including *Melaleuca erubescens*, *Melaleuca nodosa*, *Melaleuca decora* and *Ptilothrix deusta*. Several other variations have yet to be defined in detail. Further survey and analysis are required to investigate and clarify these patterns.

### 3.2 Distribution

KSSW is restricted to the general Kurri Kurri - Cessnock area within the Cessnock Local Government Area in the Lower Hunter Valley of NSW (Figure 1). Due to its specific habitat requirements (restricted to soils developed over sand deposits), the community has a relatively restricted distribution with a linear range of only approximately 21 km.

The regional distribution of KSSW has been modelled by NSW National Parks and Wildlife Service (2000) as part of a vegetation mapping project for the Lower Hunter and Central Coast regions undertaken by the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS). NSW National Parks and Wildlife Service (2000) report that mapping of this community was difficult, as not all sand deposits have been mapped on the available soil landscape maps for the region. Predavec *et al.* (2001) partly ground-truthed and revised the above vegetation map for KSSW. However, local scale vegetation surveys within the Lower Hunter (e.g. Bell 2004a, b; FloraSearch 2004) have revealed that the available regional scale mapping (NSW National Parks and Wildlife Service 2000; Predavec *et al.* 2001) provides a very poor representation of the actual distribution of KSSW. Gaining greater insight into the distribution of KSSW is a high priority.

### 3.3 Land tenure and zoning

KSSW occurs on both public and private land. Land-use on private property primarily includes residential and industrial and, to a lesser extent, agriculture. The area has a long history of underground coal mining and consequently much of the above ground areas were protected from agricultural development and largely remained as crown land. Public lands include crown land (both vacant and leased), State Forest (Cessnock State Forest and Aberdare State Forest) and National Park (Werakata National Park) (see Figure 1).

Detailed investigation of the tenure and zoning of lands supporting KSSW will be undertaken once a reliable vegetation map is available across the entire distribution of KSSW. Preliminary investigation of zoning by Predavec *et al.* (2001) using the available mapping (NPWS 2000, Predavec *et al.* 2001) reveals that the majority (>70%) of lands supporting KSSW are zoned rural.

A number of unresolved Aboriginal Land Claims occur on lands supporting KSSW (Predavec *et al.* 2001).

KSSW is inadequately represented in conservation reserves. A number of small areas of KSSW occur within Werakata National Park, totalling approximately 400 ha and approximately 16% per cent of the total current known distribution of KSSW. This 400 ha represents the only example of KSSW under long-term protection. An additional 380 ha (15% of total KSSW) of KSSW occurs on lands zoned 7(b) Habitat Protection.

### 3.4 Habitat

KSSW occurs within a warm temperate climatic zone, with warm wet summers and cool dry winters. Rainfall generally peaks in late Summer and early Autumn, although local variations due to topography are evident, with an annual average of 748 mm per year. Temperatures range from a daily average low of 4 degrees Celsius in July to August, to a high of 30 degrees Celsius in December and January (Bureau of Meteorology 2005).

KSSW occurs generally on level to slightly undulating sand deposits within the Maitland and Dalwood Groups of Permian sediment geology, although the community can also occur on claypans in close proximity to these sand deposits (Bell 2004b).

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5 Based on Bell (2004a, b)
3.5 Ecological processes

To effectively manage and conserve KSSW it is important we have an understanding of the ecological processes that influence the ability of KSSW to respond to disturbance. The frequency of disturbance, particularly fire, is of vital importance for the management and conservation of KSSW. It is likely that too frequent disturbance, and also potentially a long-term absence of disturbance, may be detrimental to the persistence of KSSW.

While there is a general understanding of the basic fire ecology of some of the component species of KSSW, the fire ecology of KSSW at a community level is not well understood. However in a general sense, too frequent fire and also infrequent fire may lead to a reduction in species diversity and alter the structure and species composition of KSSW.
Frequent fire will lead to a reduction in fire sensitive species (e.g. obligate seed regenerators). Generally, for species killed by fire the presence of a seed bank is essential for persistence after a fire event unless propagules of the species are widely dispersed (Auld et al. 2000; Keith 1996). If fires occur at an interval too small to allow re-establishment of a soil stored seed bank following a previous fire then local extinction will occur.

Fire exclusion or infrequent fire will also potentially lead to a reduction in species diversity, particularly those dependent on fire for seedling recruitment which may become locally extinct in its absence (Gill and Bradstock 1995).

The critical fire frequencies for KSSW have not yet been determined, although Bell (2004a) suggests the fire free interval for KSSW should be 5-15 years. He suggested the current composition reflects regular fire, however longer intervals are suggested to encourage seeders and hence enhance species diversity. In light of current knowledge, the DECC requires that fire not occur more than once every ten years in KSSW within the context of the issuing of Bush Fire Hazard Reduction Certificates. This requirement is stated in the Threatened Species Hazard Reduction List.

3.6 Ability to recover

‘Recovery’ in the context of this plan, is to ensure the continued and long-term persistence of KSSW. The likelihood of recovery of KSSW in this context is high provided the recovery actions outlined in this plan are implemented, monitored and amended as required.

4 Threats and Management Issues

4.1 Threats

Habitat loss and fragmentation

A major threat to the persistence of KSSW is continued habitat loss and fragmentation due to clearing for urban and industrial development and associated infrastructure such as roads and power easements. As much as 50%6 of the original distribution of the community may have been cleared, with much of the remaining remnants becoming increasingly fragmented by development. In particular, a planned link road between the F3 Freeway and the New England Highway will increase fragmentation of KSSW.

The fragmentation of KSSW remnants has many potential consequences, all of which decrease the likelihood of KSSW persisting, including a reduction in species diversity; an increased susceptibility to habitat degradation (see below) through increased edge-to-area ratios; changes in the fluxes of radiation, wind, water and nutrients across the landscape; the genetic isolation of populations which may result in the loss of genetic diversity and decrease the ability of populations to adapt to environmental change; and altered disturbance regimes.

Habitat degradation

The remaining KSSW remnants are threatened by habitat degradation. Some of the main causes of habitat degradation for KSSW include:

• inappropriate fire regimes, particularly frequent fire;
• physical damage and/or erosion from trail bike riding, vehicles, and rubbish dumping;
• changes to drainage conditions and nutrient levels due to clearing of adjacent lands.
• mowing, slashing and grazing; and
• localised weed invasion.

The degree to which each of the above processes cause habitat degradation varies among sites.

4.2 Limits to current knowledge

There is currently an inadequate understanding of the floristics (species composition) (see Section 3.1) and distribution (see Section 3.2) of KSSW. A lack of this information hinders determining the relative significance of KSSW remnants and makes decision making regarding strategic planning and development assessment difficult and also hinders recovery plan implementation. This limit to knowledge is being addressed in Actions 1.1 and 1.2, which will commence in 2005/06.

There is also currently inadequate information on how to effectively manage KSSW. In particular the factors that influence ecosystem function in KSSW and hence long-term viability of the community are not well understood (see section 3.5). Whether or not there is capacity to effectively revegetate areas that previously supported KSSW is also unknown at this point in time (see Section 4.3). High priority questions, the potential means of investigating these questions, and the benefits of such investigations are identified in Table 1.

6 Based on regional scale mapping (NPWS (2000) and Predavec et al. (2001)) and likely to be revised following further investigations into the floristics and distribution of KSSW as part of recovery plan implementation.
### Table 1. Research questions that will assist in the effective conservation and management of KSSW. The justification for the research and the methodology that may be used to address each question is broadly identified, as are the potential benefits of the increased knowledge.

<table>
<thead>
<tr>
<th>Question</th>
<th>Justification</th>
<th>Potential methodology</th>
<th>Benefits of increased knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does fire frequency influence the viability of KSSW?</td>
<td>Both frequent and infrequent fire may lead to a reduction in species diversity and alter the structure and species composition of KSSW.</td>
<td>Experimental investigation of the impact of fire frequency on the species composition and structure of KSSW.</td>
<td>Provide land managers and consent and determining authorities with more detailed recommendations for appropriate fire management.</td>
</tr>
<tr>
<td>What are the lower and upper thresholds of inter-fire intervals for KSSW?</td>
<td>A considerable amount of KSSW occurs adjacent to residential and industrial areas and is often targeted for hazard reduction burns. It is important that these burns be undertaken at a time and intensity that benefits KSSW.</td>
<td>Long-term monitoring of species composition and structure of selected KSSW sites and collection of fire frequency, intensity and season data for monitored sites.</td>
<td>Provide greater insight into the degree frequent fire threatens KSSW and hence assist in identifying how much effort should be placed on fire suppression activities.</td>
</tr>
<tr>
<td>Does season or intensity of fire influence the impact of fire on KSSW?</td>
<td></td>
<td>Collect available fire frequency data for KSSW and explore in relation to current species composition and structure (i.e. proportion of fire sensitive species, species diversity, proportion of exotic species).</td>
<td></td>
</tr>
<tr>
<td>Can we manage power easements or asset protection zones better to decrease the impact on KSSW?</td>
<td>A considerable amount of KSSW is bisected by power easements or occurs in asset protection zones. Current practice is to slash these areas at regular intervals. Little thought has been given to how the timing or degree (i.e. height) of slashing may be used to decrease impact.</td>
<td>Experimental investigation of the impact of slashing frequency, timing and height on the species composition of KSSW.</td>
<td>Provide land managers with more detailed recommendations for appropriate management of KSSW under power easements or in asset protection zones.</td>
</tr>
<tr>
<td>What are the most effective methods of rehabilitating degraded areas of KSSW?</td>
<td>Degraded areas of KSSW require rehabilitation and it is important that the most cost efficient and effective methods are used.</td>
<td>When rehabilitating areas trial a range of methodologies and approaches and monitor, evaluate and document outcomes.</td>
<td>Efficient and effective rehabilitation of degraded areas.</td>
</tr>
<tr>
<td>Can we effectively revegetate areas that previously supported KSSW to reconstruct the community?</td>
<td>Some cleared areas that previously supported KSSW may be considered for revegetation, particularly to reconnect fragmented areas. When deciding whether to revegetate areas and how much resources to put into such programs it is important we understand the feasibility of effectively reconstructing the community.</td>
<td>Experimental revegetation: trial a range of methodologies and approaches and monitor, evaluate and document outcomes.</td>
<td>Increased understanding of our ability to reconstruct KSSW and of the appropriate methods of doing so.</td>
</tr>
<tr>
<td>What is the long-term impact of changes to nutrient and hydrological regimes?</td>
<td>A number of KSSW remnants occur adjacent to cleared areas and receive increased water run-off and nutrient levels.</td>
<td>Monitor the changes in species composition in areas subject to altered nutrient and hydrological regimes and compare with nearby similar sites not subject to such influences.</td>
<td>Land managers would gain greater insight into the need for reducing water and nutrient run-off into KSSW. Consent and determining authorities would have greater information to enable them to effectively determine the impact of a proposed development on the woodland.</td>
</tr>
</tbody>
</table>

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*Department of Environment and Climate Change (NSW)*
4.3 Rehabilitation and revegetation

It may be necessary to rehabilitate degraded areas of KSSW or revegetate areas that previously supported KSSW. As outlined in Section 4.2 and Table 2, there is very little insight into the most cost efficient and effective methods for rehabilitating degraded areas of KSSW, nor is it known whether areas that previously supported KSSW can be effectively revegetated to reconstruct the community. Indeed, studies of attempts to recreate vegetation communities in the past have revealed that development of restored sites towards a state that resembles the original/desired community is, at best, extremely slow and may not even occur at all (Wilkins et al. 2003). Consequently, it is vital for KSSW that any future approaches to compensating for the loss of natural KSSW though reconstruction of cleared or highly degraded areas recognise that compensation sites may never fully replace ‘natural’ sites.

It is vital that any rehabilitation or revegetation programs for KSSW: identify clear restoration goals; be conducted in an experimental manner, trialling a range of methodologies and approaches; and include a long term commitment to monitoring, evaluation, documentation and on-going management.

Rehabilitation programs must utilise the in-situ resilience of the remnant to the fullest extent practical, by applying low level intervention techniques (i.e. natural regeneration from the soil seed bank and other propagules on site) whenever possible (see Perkins 2003).

It is important that any material to be used in rehabilitation or revegetation programs be sourced from large remnants within a few kilometres of the recipient site(s). Given the apparent variability within KSSW (see Section 3.1) it is also important that material used matches the species composition of the recipient site.

Any revegetation or rehabilitation works, including weed control, within KSSW require a Section 132C licence from DECC if no other approvals are required under the EP&A Act.

5 Previous/Existing Recovery Actions

5.1 Survey and mapping

As outlined in Section 3.2, the regional distribution of KSSW has been modelled by NPWS (2000) and partly ground-truthed and revised by Predavec et al. (2001). However, this regional-scale map provides a very poor representation of the actual distribution of KSSW because the available soil landscape maps do not map all sand deposits within the region. Finer scale and more accurate vegetation mapping involving extensive ground-truthing has been undertaken at specific sites within the distribution of KSSW including Werakata National Park (Bell 2004a), Hunter Economic Zone (HEZ) (Bell 2004b), and Hydro Aluminium buffer lands (FloraSearch 2004). A reliable vegetation map across the entire distribution of KSSW will be produced as part of recovery plan implementation.

5.2 Recovery team

A KSSW Recovery Team was established in June 2005 to guide the DECC in the preparation and implementation of this recovery plan. The recovery team contains representatives from the DECC, Cessnock City Council, Forests NSW, Hunter-Central Rivers Catchment Management Authority, Department of Lands, Roads and Traffic Authority, the Rural Fire Service, and also includes representatives from environmental consulting, research, industry, and the local community. In January 2006 the membership and responsibilities of the KSSW Recovery Team were transferred to the Hunter Valley Threatened Flora Recovery Team.

5.3 Community education, awareness and involvement

A stakeholder forum was held for the KSSW recovery program in March 2005. The objectives of the forum were to:

1. increase awareness among stakeholders that the KSSW recovery program has commenced;
2. ensure all stakeholders are identified early in the program;
3. ensure DECC is aware of all relevant programs and resources; and
4. gain insight into likely interest, support, and involvement of various stakeholders in the recovery program.

The forum was attended by approximately 50 representatives from a range of organisations including local community groups, Cessnock City Council, various state government departments, industry, and various local experts and environmental consultants.

An email group list for the KSSW recovery program has been established (approximately 70 names on list as of Sept 2005) and a brief electronic newsletter providing information on the activities of the KSSW recovery program is distributed every few months.
A range of community groups in the Kurri Kurri - Cessnock area undertake community education and awareness activities for KSSW. The Werakata National Park Discovery Rangers undertake information walks within KSSW for the general public. The Friends of Tumblebee group produced a 2006 Calendar of the threatened species of the Kurri Kurri Area, which included information on KSSW and the threatened species that occur within KSSW. The Friends of Werakata National Park and Kurri Tidy Towns have commenced planning community education programs for KSSW which will be established as part of recovery plan implementation.

5.4 Ecological studies

Very few ecological studies have been undertaken on KSSW, although the community has been the subject of a number of flora and fauna surveys, including those undertaken within Werakata National Park (Bell 2004a, DEC 2005) and the buffer lands of Hydro Aluminium (Cenwest Environmental Services 2004; Greg Richards and Associates 2004; and FloraSearch 2004). Hydro Aluminium has recently commenced a monitoring program investigating the impact of a control burn on KSSW. Further ecological studies will be undertaken by Hydro Aluminium as a component of a Property Management Plan. Acacia bynoeana, a threatened species that occurs within KSSW is currently the subject of a PhD (pers. comm. Colin Driscoll).

5.5 In-situ protection and habitat management

Approximately 400 hectares\(^7\) of KSSW occurs within Werakata National Park. This 400 hectares represents the only example of KSSW under long-term protection, however, active protection and habitat management of KSSW does/will occur at a number of sites outside of the National Park.

KSSW also occurs in the buffer lands of an aluminium smelter managed by Hydro Aluminium. These buffer lands are actively managed and have been excluded from public access by extensive fencing. Consequently, physical damage and/or erosion from trail bike riding, vehicles, and rubbish dumping is considerably reduced at this site in comparison to other areas of KSSW. A Property Management Plan for Hydro Aluminium Kurri Kurri has been approved by the DECC under Section 113B of the Threatened Species Conservation Act 1995.

The 7(b) lands within the proposed HEZ Industrial site support areas of KSSW. These lands are to be actively managed for conservation with issues such as access, fire frequency and weed control addressed. A Habitat Management Strategy is currently being prepared for these lands.

6 Proposed Recovery Objectives, Actions and Performance Criteria for 2006-2010

The overall objective of this recovery plan is to maintain and improve the current extent, condition, and ecological function of KSSW across the community’s entire pre-European settlement distribution.

Specific objectives of the recovery plan are listed below. For each of these objectives a number of recovery actions have been developed, each with a performance criterion.

Specific objective 1: To gain greater insight into the distribution, floristics, and variance within KSSW and to investigate the relative significance of KSSW remnants

There is currently an inadequate understanding of the floristics (see Section 3.1) and distribution (see Section 3.2) of KSSW. A lack of this information hinders determination of the relative significance of KSSW remnants and makes decision making regarding strategic planning and development assessment difficult, and also hinders recovery plan implementation.

Action 1.1. The Department of Environment and Climate Change will coordinate the production of a revised classification and accurate vegetation map across the distribution of KSSW, incorporating all recognisable variations.

Performance criterion 1.1: A vegetation map across the distribution of KSSW has been completed and made publicly available by year 1.

The Hunter-Central Rivers CMA and its sub-committee the Wallis, Fishery and Four Mile Creek Catchment Management Forum; Roads and Traffic Authority; the NSW Department of Premier and Cabinet; and Cessnock City Council have contributed funds towards the implementation of this specific objective and their support is greatly appreciated.

Action 1.2. The Department of Environment and Climate Change in consultation with the recovery team will coordinate the preparation of an assessment of the relative significance of KSSW remnants.

Performance criterion 1.2: An assessment of the relative significance of KSSW remnants has been completed by year 2.
Action 1.3. The Department of Environment and Climate Change in consultation with the recovery team will provide the NSW Scientific Committee with a revised description and species composition list for KSSW to ensure the Final Determination for KSSW accurately reflects the actual composition of the community.

Performance criterion 1.3: The NSW Scientific Committee has been provided with a revised description and species composition list for KSSW by the end of year 1.

Action 1.4. The Rural Fire Service will identify Asset Protection Zones for existing structures that occur within or adjacent to areas of KSSW identified by Action 1.1 of this recovery plan.

Given the close proximity of KSSW to existing development, many occurrences of KSSW will need to be managed along their urban-interface to provide for safe ‘set-backs’ for existing structures. These ‘set-backs’ for bush fire protection are known as Asset Protection Zones. The relative significance of KSSW remnants (see Action 1.2) can only be determined once the geographical location and extent of these Asset Protection Zones is known.

Performance criterion 1.4: Asset Protection Zones for existing structures that occur within or adjacent to areas of KSSW to be determined by year 2.

Specific objective 2: To provide public authorities with information that assists in conserving and managing KSSW

The prompt and effective distribution of information on KSSW is an important component of ensuring that the conservation requirements of the woodland are appropriately considered in decisions regarding land-use planning, development control, hazard reduction activities, and land management.

Action 2.1. The Department of Environment and Climate Change in consultation with the recovery team will develop a field identification guide and environmental assessment guidelines for KSSW and distribute them to all relevant public authorities.

Performance criterion 2.1: Survey and environmental assessment guidelines have been developed and are publicly available by year 2.

Specific Objective 3: To raise awareness of KSSW and facilitate community involvement in the recovery program

Increased community awareness and involvement is vital for the effective implementation of this recovery plan and will enhance the social benefit of the program.

Action 3.1: The Department of Environment and Climate Change in consultation with the recovery team will distribute general information on the progress of the recovery program to raise awareness of the recovery program and encourage community involvement in its implementation.

The DECC will continue to distribute a brief electronic newsletter, providing information on the activities of the KSSW recovery program, to the KSSW e-mail list (see Section 5.3).

The DECC will also prepare an annual newsletter on threatened species recovery planning in the Lower Hunter and will include information on the progress of the KSSW recovery program. The newsletter will be distributed to selected landholders, community groups and local schools.

Performance Criterion 3.1: General information on the progress of the recovery program is distributed to the community at least once annually for the life of the plan.

Action 3.2: The Department of Environment and Climate Change, Cessnock City Council and the Hunter-Central Rivers Catchment Management Authority will raise awareness of, and encourage community involvement in, the recovery program.

Under this action, DECC, Cessnock City Council, and Hunter-Centra Rivers CMA, will raise awareness of the recovery program amongst community groups, landholders and interested individuals, and will encourage involvement in the implementation of recovery actions including rubbish removal, weed control, bush regeneration, site protection and community education.

Performance Criterion 3.2: At least two community groups or landholders are actively involved in the implementation of recovery actions each year.

Action 3.3: The Department of Environment and Climate Change, Cessnock City Council and the Hunter-Central Rivers Catchment Management Authority will assist community groups and landholders in obtaining funds to undertake recovery actions within KSSW.

Community groups and landholders, if provided adequate funding, would be able to assist in the implementation of on-ground recovery actions.

Performance Criterion 3.3: At least two funding applications prepared annually to undertake on-ground recovery actions within KSSW.

Action 3.4: The Department of Environment and Climate Change will facilitate the establishment of interpretive walks within KSSW to educate the community regarding the significance of the vegetation and to raise awareness of the recovery program.
As introduced in Section 5.3, The Friends of Werakata National Park and Kurri Tidy Towns have commenced planning community education programs for KSSW. The DECC will coordinate the design, production, installation and promotion of interpretative material. Funds for the interpretive materials and associated on-ground management have been provided to DECC by the New England Trading Company.

Performance Criterion 3.4: Community education programs completed and launched by year 2, in collaboration with Friends of Werakata National Park and Kurri Tidy Towns.

**Action 3.5:** *The Department of Environment and Climate Change will produce and promote a Teacher Resource Kit for primary and infant school teachers in the Kurri Kurri – Cessnock area.*

Performance Criterion 3.5: A Teacher Resource Kit produced and distributed to all primary and infant schools in the Kurri Kurri – Cessnock area by year 2, with ongoing promotion of the kit each year.

**Specific Objective 4:** To identify and minimise the threats operating at sites where KSSW occurs and to ensure appropriate ecological restoration where necessary and feasible

Threats operating at sites supporting KSSW (in addition to land clearing) include: mowing and slashing, dumping of rubbish and garden waste, weed invasion, and an inappropriate disturbance regime, particularly frequent fire. Actions under this objective aim to manage these threats through the implementation of appropriate in-situ threat abatement measures.

**Action 4.1:** *The Department of Environment and Climate Change in consultation with the recovery team, will prioritise sites for active management (i.e. bush regeneration, site protection measures).*

The criteria for this process will be based upon factors influencing the ecology of the remnant including size, disturbance history, species diversity/site quality, ability to recover and existing threats. Resource allocation would then need to be guided by such factors as security/tenure of site, ability to reduce current local threats and the availability of community resources such as community conservation groups.

Performance Criterion 4.1: Priority lands for active management have been identified by year 2.

**Action 4.2:** *The Department of Environment and Climate Change, Cessnock City Council, Department of Lands, and Forests NSW will prepare and implement management statements (site specific where possible) for land(s) known to support KSSW under their management in accordance with the aims and objectives of this recovery plan.*

The management statements should address the relevant management issues which may include: fire management, weed management, site hydrology (increased nutrient status, run-off), site visitation (access and usage), rubbish removal, protective fencing, and use of educational and interpretive signs. Statements are to detail the specific threat abatement measures required (if any) and a timetable to implement these measures. The level of information provided may depend on the agencies land holdings.

All on-ground restoration work within KSSW will be undertaken by, or under the direct supervision of a person, or persons, with training (such as TAFE certification) and experience in bush regeneration techniques. This work will be guided by site management statements.

Performance Criterion 4.2: Management statements for relevant sites prepared within two years and implemented within three.

**Action 4.3:** *The Department of Environment and Climate Change will liaise with selected landholders/managers of private land supporting KSSW to facilitate the implementation of appropriate threat abatement measures.*

Priority private land managers include EnergyAustralia, Hydro Aluminium, Hunter Water and Mindaribba Local Aboriginal Land Council.

Performance Criterion 4.3: At least two landholders/managers of private land provided with advice regarding the management of KSSW each year for the life of the plan.

**Specific objective 5:** To initiate potential conservation of KSSW on private property

Only approximately 16% of KSSW occurs within conservation reserves (Section 3.3). This objective aims to increase the long-term protection afforded to priority remnants of KSSW on private property.

**Action 5.1:** *The Hunter-Central Rivers Catchment Management Authority and the Department of Environment and Climate Change will advise selected landholders of the opportunities and advantages of entering into conservation agreements and covenants.*

The Hunter-Central Rivers CMA and the DECC will notify selected landholders of the presence of KSSW on their land and will inform them of the opportunities and advantages of entering into conservation agreements and covenants. Opportunities for such agreements include Voluntary Conservation Agreements (VCAs)
under the NP&W Act, Joint Management Agreements and Property Management Plans under the TSC Act, Property Vegetation Plans under the NV Act and appropriately worded covenants under the Conveyancing Act 1919.

Performance Criterion 5.1: Selected owners of private land supporting KSSW will be notified, within three years, of the presence of KSSW and of the advantages of entering into a conservation agreement or covenant.

Specific Objective 6: To promote research and monitoring projects that will assist future management decisions

As outlined in Section 4.2, there are a number of potential research projects that could assist in the management of KSSW. However, given the absence of funds to conduct this research, this plan advocates the promotion and facilitation of potential research projects rather than funding the actual research.

Action 6.1: The Department of Environment and Climate Change to promote and facilitate potential research projects as identified in this recovery plan.

The DECC will encourage tertiary and research institutions to conduct research into the ecology of KSSW consistent with the priorities outlined in Section 4.2 and Table 1.

Performance Criterion 6.1: At least five tertiary and research institutions contacted regarding potential research areas by year 3.

Action 6.2: The Department of Environment and Climate Change will supervise a Newcastle University Environmental Management Placement Study (Unit code - EMGT3090) investigating aspects of the fire ecology of KSSW.

Performance Criterion 6.2: A Environmental Placement research project completed by year 3.

Specific Objective 7: Broaden legislative protection afforded KSSW

KSSW is currently not listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Action 7.1. The Department of Environment and Climate Change will coordinate a nomination for the listing of KSSW as a Threatened Ecological Community under the Commonwealth EPBC Act.

Performance criterion 7.1: KSSW has been nominated for listing under the EPBC Act within one year of implementation of this plan.

7 Implementation

Table 2 (page 14) outlines the implementation of recovery actions specified in this recovery plan by relevant government agencies and/or parties for the period of five years from publication.

The total cost to implement this plan is estimated to be at least $219,900 over five years, although this does not include the costs associated with the preparation and implementation of site management statements for public lands, as these costs are yet to be determined. Over half of the required funds ($130,000) have already been provided by external sources and the DECC will make an in-kind contribution of over $42,900. The remaining $47,000 will be sought from external sources. Tasks still requiring external funding include encouraging community involvement in recovery plan implementation, development and promotion of a teacher resource kit, and prioritisation of sites for active management.

8 Social and economic consequences

8.1 Social consequences

Negative social impacts are not envisaged as the implementation of this recovery plan is not expected to affect public land usage to any great extent, and modification of private land management will occur at the land managers’ discretion. Continued liaison with the local community, affected landholders and government agencies will address and minimise any unforeseen negative social impacts arising from the conservation of KSSW.

It is expected that recovery plan implementation, including a community education and awareness program, will have positive social impacts on the local Kurri Kurri and Cessnock communities.

8.2 Economic consequences

The economic consequences of this recovery plan are those costs that are associated with its implementation. These include on-ground habitat management, conducting vegetation survey and mapping, community education and awareness, and on-going recovery program coordination. These costs can be off-set and minimised by seeking funds from external sources and adopting a cooperative approach to management, involving the relevant land managers and the community.

The improved environmental impact assessment that will result from mechanisms established in this recovery plan will assist consent and determining authorities to meet their statutory
responsibilities and will decrease the costs and time associated with undertaking impact assessment for KSSW.

It is anticipated that the overall benefits to society of implementation of the recovery plan will outweigh any specific costs.

9 Biodiversity Benefits

The conservation and study of KSSW will benefit numerous threatened species that occur within the community.

KSSW provides habitat for a number of rare and threatened flora species including Eucalyptus parramattensis subsp. decaden (Vulnerable-V), Grevillea parviflora subsp. parviflora (V), Acacia bynoeana (Endangered-E), Callistemon linearifolius (V), and Rutidosis heterogama (V). The community also supports the rare species Grevillea montana and Macrozamia flexuosa, and two undescribed Eucalyptus species: Eucalyptus sp. aff. camfieldii and Eucalyptus sp. aff. agglomerata. The community also provides potential habitat for Cryptostylis hunteriana (V) based on similarity of floristics and soil types to other known habitats and Tetratheca juncea (V) could potentially occur within the dryer sand-based forms of the KSSW (Bell 2004b).

KSSW also provides habitat for a number of threatened fauna species, particularly threatened woodland birds e.g. Brown Treecreeper (V), Black-chinned Honeyeater (V), Grey-crowned Babbler (V), Diamond Firetail (V) and Speckled Warbler (V); and bats e.g. Little Bentwing-bat (V), Eastern Bentwing-bat (V), and Eastern Freetail Bat (V). The community supports a high frequency of winter flowering plants and provides a potential food resource for nectivorous fauna including the Squirrel Glider (V) and Regent Honeyeater (E).

The actions identified in this recovery plan, particularly the vegetation mapping, will also increase our understanding of the distribution and floristics of other endangered ecological communities in the Lower Hunter, including Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowland Redgum Forest.

10 Preparation Details

This recovery plan has been prepared by Tricia Hogbin of the DECC’s Biodiversity Conservation Unit, North East Region, in consultation with the KSSW Recovery Team.

11 References


NSW National Parks and Wildlife Service 2000, Vegetation survey, classification and mapping. Lower Hunter and Central Coast Region. V1.1. A project undertaken for the Lower Hunter and Central Coast Regional Environmental Management Strategy, NSW.


12 Acronyms Used in this Document

CMA Catchment Management Authority
DECC Department of Environment and Climate Change (NSW)
E Endangered
EP&A Act NSW Environmental Planning and Assessment Act 1979
EPBC Act Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FNSW Forests NSW (formerly State Forests of NSW)
HEZ Hunter Economic Zone
KSSW Kurri Sand Swamp Woodland
LHCCREMS Lower Hunter Central Coast Regional Environmental Management Strategy
NSW New South Wales
NPW Act NSW National Parks and Wildlife Act 1974
NV Act NSW Native Vegetation Act 2003
RFS Rural Fire Service
RTA Roads and Traffic Authority
SIS Species Impact Statement
TAFE Technical and Further Education
TSC Act NSW Threatened Species Conservation Act 1995
V Vulnerable
VCA Voluntary Conservation Agreement
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¹ Priority ratings are: 1 Action critical to meeting plan objectives, 2 Action contributing to meeting plan objectives, 3 Desirable but not essential action.

² # No direct cost (either cost of action is negligible or action is an existing responsibility of the responsible party), * Amount to be determined by the responsible party

³ DECC: Department of Environment and Climate Change; RFS: Rural Fire Service; CCC: Cessnock City Council; HCRCMA: Hunter-Central Rivers Catchment Management Authority; Lands: Department of Lands; FNSW: Forests NSW.

⁴ In kind funds represent the salary component of permanent staff and recurrent resources. External funds are those that have already been provided by external sources.

Unsecured funds will be sought from external sources

³ 35% HCRCMA, 30% RTA, 20% New England Trading Company, 10% Department of Premier and Cabinet, 5% CCC

⁶ New England Trading Company
### 13 Appendix 1. Summary of advice from the NSW Scientific Committee

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